findings[4], germination was not necessary for antibiotic production. In fact, recolonization of the inhibited zone was more rapid with viable germinating seeds than with autoclaved seeds.

Some variation occurred between individual seeds but variation between species was more marked. Autoclaved seed of three separate samples of three forage legume species were tested with *Rhizobium trifolii* strain *TA*1. Inhibition was strong with subterranean clover (mean 5·8 mm.), considerably less with white clover (1·5 mm.), and weak with lucerne (0·3 mm.). Differences in seed size do not adequately explain these differences, as lucerne seed is larger than that of white clover.

Field evidence, suggesting the presence in subterranean clover seed of substances inhibitory to *Rhizobia*, has been obtained at this laboratory. Spencer (personal communication) found that soaking of seed prior to inoculation and sowing resulted in greatly improved nodulation from the applied inoculum. On the other hand, when inoculum was applied to the soil there was no beneficial effect of soaking seed. I have found that physical separation of the seed coat and inoculum, by coating the seed with inert material before inoculation, improved nodulation of subterranean clover.

The results presented indicate that the seed coats of the subterranean clover investigated contain a thermo-stable, water-soluble antibiotic, active against a strain of *Rhizobium* normally incorporated in commercially prepared inocula. This substance could contribute to loss of viability of nodule bacteria on the seed both in storage and in field sowings.

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[1] Fred, E. B., Baldwin, I. L., and McCoy, Elizabeth, "Root Nodule Bacteria and Leguminous Plants" (University of Wisconsin Press, Madison, 1932).
[2] Vincent, J. M., Proc. Univ. of Nottingham Fifth Easter School of Agric. Sci., 108 (Butterworths, London, 1959).
[3] Lobb, W. R., *N.Z. J. Agric.*, **96**, 556 (1958).
[4] Ferenczy, L., *Acta Biol. Acad. Sci. Hung.*, **6**, 317 (1956).
[5] Ark, P. A., and Thompson, J. P., *Plant Dis. Rep.*, **42**, 959 (1958).
[6] Maruzzella, J. C., and Freundlich, M., *Nature*, **187**, 972 (1959).
[7] Osborn, E. M., and Harper, J. L., *Nature*, **167**, 685 (1951).
[8] de Beer, E. J., and Sherwood, Marion B., *J. Bact.*, **50**, 459 (1945).

## Effect of Autumn Applications of Potassium Gibberellate on Fruit Production of the Strawberry

In the autumn of 1957 at New Brunswick, New Jersey, single-row, 30-ft. replicated plots of Sparkle strawberries were treated with 20 and 50 p.p.m. of potassium gibberellate. Three applications were made, with the first application applied on September 13. An additional variable was added by using both a 1-week and 2-week interval between spray applications. No effect was noted in the autumn of 1957 from these sprays except for an occasional inflorescence observed on the plots sprayed with 50 p.p.m. The next spring the sprayed plots had a heavier bloom early in the flowering period as compared with the unsprayed plots. The harvest records for 1958 showed that the treated plots produced about a 30 per cent larger volume of early fruit than the unsprayed checks, with no difference due to interval between spray applications. Due to rains and fruit rots during the latter part of the 1958 harvest season, total yield records were not recorded.

In the autumn of 1958 another investigation was conducted using 30-ft. single-row plots of Sparkle strawberry plants. Each treatment was replicated five times. Treatments consisted of 0, 10, 20, 30, 40, 50 and 100 p.p.m. of potassium gibberellate (supplied by Merck and Co., Rahway, New Jersey, which supported this work with a grant-in-aid) applied as sprays on September 17, October 1 and October 15. Some inflorescences were observed later in the autumn on plots sprayed with 40, 50 and 100 p.p.m., and petiole elongation was observed at the 100 p.p.m. level.

Table 1. Effect of Potassium Gibberellate Sprays on Yield of Sparkle Strawberry Fruit

| Spray concentration (p.p.m.) | Yields | |
|---|---|---|
| | Early harvest* (quarts/acre) | Total† (quarts/acre) |
| 0 | 2,603 | 10,662 |
| 10 | 3,758 | 9,519 |
| 20 | 3,616 | 8,637 |
| 30 | 3,515 | 8,252 |
| 40 | 2,485 | 5,209 |
| 50 | 2,390 | 5,241 |
| 100 | 832 | 1,673 |
| *L.S.D.* 0·05 | 958 | 1,882 |
| *L.S.D.* 0·01 | 1,298 | 2,550 |

* Includes harvests of May 28, June 2 and June 5.
† Total yield was based on above three harvests plus an additional five completed by June 26, 1959.

The results obtained in the 1959 harvest season (Table 1) indicate that by June 5 (including three harvests) the 10 and 20 p.p.m. treatments had significantly increased the volume of fruit harvested as compared with the unsprayed checks: the 100 p.p.m. treatment, on the other hand, had significantly reduced yields. The total yields (including eight harvests) for these plots showed that there was no significant difference between the unsprayed checks and the 10 p.p.m. treatment, while all the other treatments showed a significant reduction in yield.

The application of three sprays of 10 p.p.m. of potassium gibberellate in the autumn may give the strawberry grower an economic advantage, since the early fresh market fruit commands a premium price.

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## Viability and Germination Inhibitor of the Seed of Rice

The loss of viability of seeds within one year after harvesting has been reported by Grist[1] from varieties of rice grown in British Guiana and by Ramiah[2] in India, but no explanation has been offered. Germination tests of a winter variety 'Rupsail' recently carried out in this laboratory indicated peak germination

Table 1. Respiration-Rates of Rice Seeds without Husk

| Year of collection | $\mu$l./$O_2$/hr./mgm. dry weight | $\mu$l./$CO_2$/hr./mgm. dry weight |
|---|---|---|
| 1956 | 0·078 | 0·054 |
| 1957 | 0·078 | 0·080 |
| 1958 | 0·142 | 0·113 |